

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
22 February 2001 (22.02.2001)

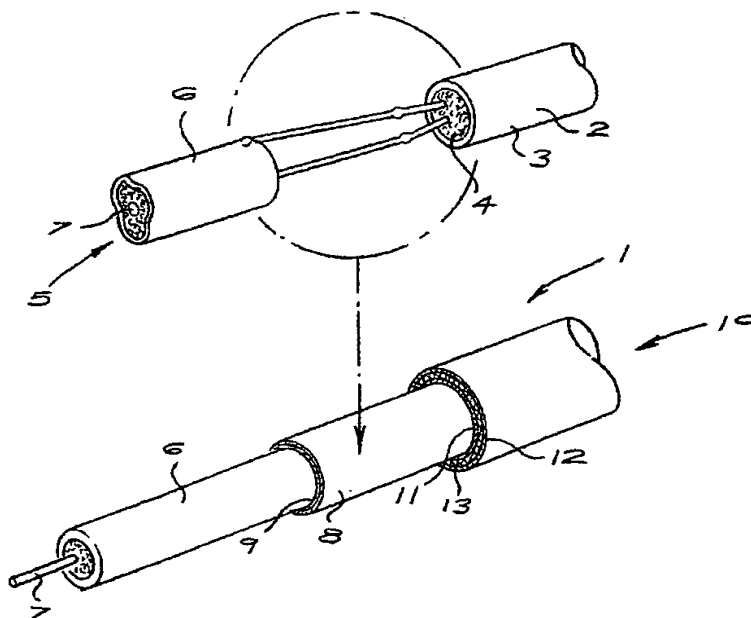
PCT

(10) International Publication Number
WO 01/13438 A1

- (51) International Patent Classification⁷: H01L 35/00, 35/32, G01K 7/02
- (21) International Application Number: PCT/ZA00/00136
- (22) International Filing Date: 16 August 2000 (16.08.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
99/5203 16 August 1999 (16.08.1999) ZA
- (71) Applicant (for all designated States except US): TEMPERATURE MANAGEMENT SYSTEMS (PROPRIETARY) LIMITED [ZA/ZA]; 42 Ceramic Curve, Alton, Richards Bay, 3900 Kwa-Zulu Natal (ZA).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): GRAY, Adrian, Lionel [ZA/ZA]; 42 Ceramic Curve, Alton, Richards Bay, 3900 Kwa-Zulu Natal (ZA).
- (74) Agent: JOHN & KERNICK; An Intellectual Property Office of Bowman Gilfillan Inc., P.O. Box 3511, 1685 Halfway House (ZA).
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: METALLURGICAL THERMOCOUPLE



(57) Abstract: This invention concerns a thermocouple which is protected by an outer sheath consisting of inner and outer tubes with the annular space filled with low temperature sintering refractory material which is preferably beaded before filling in the space and in which the outer tube is constricted to compact the material. The refractory material will include borosilicate and boric acid powder.

WO 01/13438 A1



Published:

- With international search report.
- Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ZA 00/00136

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L35/00 H01L35/32 G01K7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L G01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 317 (P-750), 29 August 1988 (1988-08-29) & JP 63 082329 A (ASAHI GLASS CO LTD), 13 April 1988 (1988-04-13) abstract	1
A	---	5
X	US 3 634 190 A (KILP GERALD R ET AL) 11 January 1972 (1972-01-11)	16
A	column 1, line 39 - line 45 column 3, line 45 - line 55 column 5, line 5 - line 15 column 6, line 20 - line 33; claim 7; figures 1-3 --- -/--	1-4, 9, 11, 12, 15

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

1 December 2000

Date of mailing of the international search report

08/12/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040. Tx. 31 651 epo nl.
Fax: (+31-70) 340-3016

Authorized officer

Ahlstedt, M

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ZA 00/00136

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 426 457 A (ZHUKOV LEONID F ET AL) 17 January 1984 (1984-01-17) column 4, line 33 - line 41; example 12 ----	1,5,7
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 07, 31 July 1996 (1996-07-31) & JP 08 073212 A (KOOMITSUKUSU:KK), 19 March 1996 (1996-03-19) abstract ----	1,5,7
A	US 3 833 387 A (GROCE I ET AL) 3 September 1974 (1974-09-03) column 4, line 12 - line 16 ----	1,5,7
A	JAU-HO JEAN. GUPTA T K: "Liquid phase sintering in the glass-cordierite system" JOURNAL OF MATERIAL SCIENCE, vol. 27, no. 6, 15 March 1992 (1992-03-15), pages 1575-1584, XP000960820 the whole document ----	1,5,6
A	US 4 732 619 A (NANIGIAN JACOB) 22 March 1988 (1988-03-22) column 4, line 55 - line 62; figure 3 -----	13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ZA 00/00136

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 63082329 A	13-04-1988	NONE	
US 3634190 A	11-01-1972	DE 1464128 A US 3409973 A	27-03-1969 12-11-1968
US 4426457 A	17-01-1984	WO 8200461 A CA 1150738 A DE 3050499 C DE 3050499 T JP 1042909 B JP 57501232 T	18-02-1982 26-07-1983 10-04-1986 26-08-1982 18-09-1989 15-07-1982
JP 08073212 A	19-03-1996	CN 1122770 A	22-05-1996
US 3833387 A	03-09-1974	US 3806362 A	23-04-1974
US 4732619 A	22-03-1988	NONE	

101069937

PATENT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

JOHN & KERNICK
An Intellectual Property Office
Bowman Gilfillan Inc.
P.O. Box 3511
1685 Halfway House
South Africa

RECEIVED
NOV - 8 2002
TECHNOLOGY CENTER 2800

Date of mailing (day/month/year) 27 September 2002 (27.09.02)	
Applicant's or agent's file reference P14027PC00	IMPORTANT NOTIFICATION
International application No. PCT/ZA00/00136	International filing date (day/month/year) 16 August 2000 (16.08.00)
International publication date (day/month/year) 22 February 2001 (22.02.01)	Priority date (day/month/year) 16 August 1999 (16.08.99)
Applicant TEMPERATURE MANAGEMENT SYSTEMS (PROPRIETARY) LIMITED et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
16 Augu 1999 (16.08.99)	99/5203	ZA	26 July 2002 (26.07.02)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer Miguel CORBEIRA Telephone No. (41-22) 338.83.38
--	--

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
in its capacity as elected Office

Date of mailing (day/month/year) 11 April 2001 (11.04.01)	
International application No. PCT/ZA00/00136	Applicant's or agent's file reference P14027PC00
International filing date (day/month/year) 16 August 2000 (16.08.00)	Priority date (day/month/year) 16 August 1999 (16.08.99)
Applicant GRAY, Adrian, Lionel	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

21 February 2001 (21.02.01)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Antonia Muller Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference P14027PC00	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/ZA 00/ 00136	International filing date (day/month/year) 16/08/2000	(Earliest) Priority Date (day/month/year) 16/08/1999
Applicant TEMPERATURE MANAGEMENT SYSTEMS LIMITED		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.
☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1
☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ZA 00/00136

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L35/00 H01L35/32 G01K7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L G01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	abstract	5
X	US 3 634 190 A (KILP GERALD R ET AL) 11 January 1972 (1972-01-11)	16
A	column 1, line 39 - line 45 column 3, line 45 - line 55 column 5, line 5 - line 15 column 6, line 20 - line 33; claim 7; figures 1-3 --- -/--	1-4, 9, 11, 12, 15



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

1 December 2000

Date of mailing of the international search report

08/12/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Ahlstedt, M

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ZA 00/00136

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 426 457 A (ZHUKOV LEONID F ET AL) 17 January 1984 (1984-01-17) column 4, line 33 - line 41; example 12 ----	1,5,7
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 07, 31 July 1996 (1996-07-31) & JP 08 073212 A (KOOMITSUKUSU:KK), 19 March 1996 (1996-03-19) abstract ----	1,5,7
A	US 3 833 387 A (GROCE I ET AL) 3 September 1974 (1974-09-03) column 4, line 12 - line 16 ----	1,5,7
A	JAU-HO JEAN. GUPTA T K: "Liquid phase sintering in the glass-cordierite system" JOURNAL OF MATERIAL SCIENCE, vol. 27, no. 6, 15 March 1992 (1992-03-15), pages 1575-1584, XP000960820 the whole document ----	1,5,6
A	US 4 732 619 A (NANIGIAN JACOB) 22 March 1988 (1988-03-22) column 4, line 55 - line 62; figure 3 -----	13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ZA 00/00136

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
JP 63082329	A	13-04-1988	NONE		
US 3634190	A	11-01-1972	DE	1464128 A	27-03-1969
			US	3409973 A	12-11-1968
US 4426457	A	17-01-1984	WO	8200461 A	18-02-1982
			CA	1150738 A	26-07-1983
			DE	3050499 C	10-04-1986
			DE	3050499 T	26-08-1982
			JP	1042909 B	18-09-1989
			JP	57501232 T	15-07-1982
JP 08073212	A	19-03-1996	CN	1122770 A	22-05-1996
US 3833387	A	03-09-1974	US	3806362 A	23-04-1974
US 4732619	A	22-03-1988	NONE		

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

To:

JOHN & KERNICK
(Intellectual Property Law Office)
P.O. Box 3511
Halfway House 1685
SOUTH AFRICA

Date of mailing
(day/month/year)

08/12/2000 /

Applicant's or agent's file reference

P14027PC00

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/ZA 00/ 00136

International filing date
(day/month/year)

16/08/2000

Applicant

TEMPERATURE MANAGEMENT SYSTEMS LIMITED

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Trudy Thoen-de Jong

RECEIVED
2000 -12- 19

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference P14027PC00	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/ZA 00/ 00136	International filing date (day/month/year) 16/08/2000	(Earliest) Priority Date (day/month/year) 16/08/1999
Applicant TEMPERATURE MANAGEMENT SYSTEMS LIMITED		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

1



None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ZA 00/00136

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L35/00 H01L35/32 G01K7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L G01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 317 (P-750), 29 August 1988 (1988-08-29) & JP 63 082329 A (ASAHI GLASS CO LTD), 13 April 1988 (1988-04-13)	1
A	abstract	5
X	US 3 634 190 A (KILP GERALD R ET AL) ✓ 11 January 1972 (1972-01-11)	16
A	column 1, line 39 - line 45 column 3, line 45 - line 55 column 5, line 5 - line 15 column 6, line 20 - line 33; claim 7; figures 1-3 --- -/--	1-4, 9, 11, 12, 15

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

1 December 2000

Date of mailing of the international search report

08/12/2000

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/ZA 00/00136

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 426 457 A (ZHUKOV LEONID F ET AL) ✓ 17 January 1984 (1984-01-17) column 4, line 33 - line 41; example 12 ---	1,5,7
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 07, 31 July 1996 (1996-07-31) & JP 08 073212 A (KOOMITSUKUSU:KK), ✓ 19 March 1996 (1996-03-19) abstract ---	1,5,7
A	US 3 833 387 A (GROCE I ET AL) ✓✓ 3 September 1974 (1974-09-03) column 4, line 12 - line 16 ---	1,5,7
A	JAU-HO JEAN. GUPTA T K: "Liquid phase sintering in the glass-cordierite system" JOURNAL OF MATERIAL SCIENCE, vol. 27, no. 6, 15 March 1992 (1992-03-15), pages 1575-1584, XP000960820 ✓ the whole document ---	1,5,6
A	US 4 732 619 A (NANIGIAN JACOB) ✓ 22 March 1988 (1988-03-22) column 4, line 55 - line 62; figure 3 -----	13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ZA 00/00136

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 63082329 A	13-04-1988	NONE	
US 3634190 A	11-01-1972	DE 1464128 A US 3409973 A	27-03-1969 12-11-1968
US 4426457 A	17-01-1984	WO 8200461 A CA 1150738 A DE 3050499 C DE 3050499 T JP 1042909 B JP 57501232 T	18-02-1982 26-07-1983 10-04-1986 26-08-1982 18-09-1989 15-07-1982
JP 08073212 A	19-03-1996	CN 1122770 A	22-05-1996
US 3833387 A	03-09-1974	US 3806362 A	23-04-1974
US 4732619 A	22-03-1988	NONE	

REC'D 20 NOV 2001

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P14027PC00	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/ZA00/00136	International filing date (day/month/year) 16/08/2000	Priority date (day/month/year) 16/08/1999
International Patent Classification (IPC) or national classification and IPC H01L35/00		
Applicant TEMPERATURE MANAGEMENT SYSTEMS (PROPRIETARY) et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of two sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 21/02/2001	Date of completion of this report 15.11.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Korb, W Telephone No. +49 89 2399 2284



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/ZA00/00136

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-6 as originally filed

Claims, No.:

1-16 as received on 28/09/2001 with letter of 07/02/2001

Drawings, sheets:

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/ZA00/00136

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1 - 14
	No:	Claims	15, 16
Inventive step (IS)	Yes:	Claims	1 - 14
	No:	Claims	15, 16
Industrial applicability (IA)	Yes:	Claims	1 - 16
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

R I t m V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. There is no doubt in regard of the possibility of an industrial applicability of the subject-matter claimed in claims 1 - 14.

Furthermore the subject-matter of Claim 1 is considered to be new and to involve an inventive step with respect to the available documents cited in the International Search Report and representing a state of the art according to Rule 64(1) PCT.

The dependent claims 2 - 14 refer to claim 1 directly or indirectly and meet the requirements for such claims with regard to novelty and inventive step.

2. The present application is related to a thermocouple comprising a sensing tip in electrical connection with a mineral insulated thermocouple cable which further comprises an additional external shielding.

The problem to be solved is to provide a thermocouple which can be made at a high cost effectiveness and can be used in the ferrous and non-ferrous industries with minor modification.

The solution is the selection of a low temperature sintering refractory material including particulate borosilicate and boric acid powder for providing the additional external shielding.

None of the available documents indicates this particular material for the same purpose. Thus the present application is related to a selection invention in as much as claims 1 - 14 are concerned.

Documents US-A-4 426 457 and PATENT ABSTRACTS OF JAPAN vol. 1996, no. 07, 31 July 1996 (1996-07-31) & JP 08 073212 A (KOOMITSUKUSU:KK), 19 March 1996 (1996-03-19) mention boric acid in a refractory powder for use in a light guide assembly or for converting wood and natural fiber into durables, for example in order to achieve a pollution-free fireproof/fire resistant material.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/ZA00/00136

Document US-A-3 833 387 relates to a protective coating composition for a thermoelectric material and discloses an enamel frit containing a small amount of boronoxide. Further document US-A-4 732 619 wherein boron can be found merely relates to liquid phase sintering in the glass-cordierite system using a borosilicate glass.

3. Reference is made to the following documents:

D1: PATENT ABSTRACTS OF JAPAN vol. 012, no. 317 (P-750), 29 August 1988 (1988-08-29) & JP 63 082329 A (ASAHI GLASS CO LTD), 13 April 1988 (1988-04-13)

D2: US-A-3 634 190 (KILP GERALD R ET AL) 11 January 1972 (1972-01-11)

4. Document D1 already discloses (see D1, abstract) a method of providing a shielding of a thermocouple by a low temperature sintering refractory material and the standard constructional features as well as drawing steps in manufacturing a thermocouple according to claim 15 are implicit to a skilled man.

Furthermore the method according to claim 15 can already directly and unambiguously be derived from the disclosure of D2 (see D2, column 1, lines 39 - 45, column 3, lines 45 - 55, column 5, lines 5 - 15, column 6, line 20 - line 33, claim 7, figures 1 - 3).

In consequence the subject-matter claimed in claim 15, in as much as the present text can be understood, is not new with regard to each of documents D1 and D2, contrary to the requirements of Article 33(2) PCT.

This applies analogously to claim 16, in as much as the present text can be understood.

Re Item VII

Certain defects in the international application

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 is not mentioned in the description, nor are

these documents identified therein.

2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
3. The description (see pages 2 - 3, "SUMMARY OF THE INVENTION") is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT (for example description: "and electrical connection"; claim 1: "in electrical connection").

Re Item VIII

Certain observations on the international application

1. Claim 16 contains references to the description and the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.
2. It is clear that the feature of a low temperature sintering refractory material including particulate borosilicate and boric acid powder for providing the additional external shielding is essential to the definition of the invention. Since independent claim 16 does not contain this feature it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

It should also be noted that the thermocouple claimed in claim 1 is not necessarily needed for carrying out the method claimed in claim 16. Furthermore the method claimed in claim 16 is not limited to the particular low temperature sintering refractory material of claim 1. Moreover the subject-matter of claim 16 is not new. Thus claims 1 and 16, although being in different categories, are not so linked as to form a single general inventive concept (Rule 13.1 PCT).

CLAIMS

1. A thermocouple comprising a sensing tip in electrical connection with a mineral insulated thermocouple cable characterised in that additional external shielding is provided by a low temperature sintering refractory material including particulate borosilicate and boric acid powder.
2. A thermocouple as claimed in claim 1 characterised in that the shielding is in the form of a sheath having inner and outer metal tubes constricted over a filler of low temperature sintering refractory material.
3. A thermocouple as claimed in claim 2 in which the outer tube is mechanically constricted to compact the filler.
4. A thermocouple as claimed in claim 3 in which the constriction is effected by drawing, swaging or rolling.
5. A thermocouple as claimed in claim 1 in which the borosilicate comprises between 6% and 10% by weight of the refractory material.
6. A thermocouple as claimed in claim 5 in which the boric acid comprises about 3% to 5% by weight of the refractory material.
7. A thermocouple as claimed in claim 5 or 6 in which the boric acid content of the refractory material is about one half of the borosilicate content.
8. A thermocouple as claimed in any one of claims 2 to 7 in which the tubes of the sheath are stainless steel.
9. A thermocouple as claimed in any one of claims 2 to 8 in which the refractory material is predried at a temperature of between 135° and 150°C.
10. A thermocouple as claimed in claim 9 in which the refractory material is at least partially sintered before the thermocouple is used.

11. A thermocouple as claimed in any one of claims 2 to 10 in which the refractory material is beaded before being formed into the sheath.
12. A thermocouple as claimed in any one of the preceding claims in which the tip is formed from a thermocouple cable with a negative metal tube housing a positive wire embedded in a low temperature sintering material as defined in any one of claims 4 to 7 above.
13. A thermocouple as claimed in any of the preceding claims 1 to 11 in which the tip is formed by providing a hot junction from the wires of the thermocouple cable and supported by a sheath as above defined with both tubes and the refractory formed to cap the hot junction.
14. A thermocouple as claimed in any one of claims 2 to 13 in which the outer tube of the sheath is annealed after the constriction process and the refractory material at least partially sintered during the annealing process.
15. A method of shielding a thermocouple comprising locating beads of suitably bound refractory material between an inner metal tube and an outer metal tube and reducing the sheath down to a predetermined size by drawing swaging or rolling during which process the beaded refractory material is compacted between the inner tube and the outer tube.
16. A thermocouple substantially as described and illustrated in Fig 1 or Fig 2 of the accompanying drawings.